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AUTHOR Sano, Keiko
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ABSTRACT

This paper proposes a hypothesis for the interpretation of tense in English from the viewpoint of how the conception of time is reflected in linguistic temporal expressions. The hypothesis is then verified in light of acquisition data. The paper claims that following from the analysis of the conception of time in Section 2, three temporal entities, namely, speech time, event time, and cognition time, and either a simultaneous or an ordinal relation between two of them, should be posited as primitives. It is argued that if the cognizer and the speaker of the embedded proposition are taken into consideration, the interpretation of tense in embedded clauses naturally follows from the principles of simple sentences. Based on the proposed hypothesis for an adult's interpretation of tense, acquisition data on the deicitic use of past forms of an English-Japanese girl are analyzed. The implications the acquisition data have on the proposed and competing hypotheses for the interpretation of tense are discussed. Analysis is confined to the temporal relations, either simultaneous or anterior to the speech time. The posterior relations are not included because they involve the modal auxillary "will," and the question of whether a structure with "will" reflects only a temporal relation or the wider notion of possibility under which futurity may be subsumed is still open. (VWL)

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On the Interpretation of the Past Tense and the Acquisition of English

Keiko Sano
Keio University

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On the Interpretation of the Past Tense and the Acquisition of English[1]

Keiko Sano
Keio University

1. Introduction

'What is time' is still an open question, nevertheless we conceive of time, and our concept of time is reflected in our language. The present work proposes a hypothesis for the interpretation of tense in English from the viewpoint of how our conception of time is reflected in linguistic temporal expressions. The hypothesis is then verified in light of acquisition data.

A number of theories on the interpretation of tense emphasizing the different aspects tense bears have been proposed. According to the theory, the primitives posited vary. Regarding the semantic structure and the mapping to linguistic expressions, Reichenbach (1947) and his successors (Ota 1973; Smith 1981; Declerck 1986; Hornstein 1990; among others) claim that three temporal entities, namely, Speech time, Event time and a third, rather controversial term called Reference time, are indispensable and tense is interpreted in terms of a relation of these three terms.[1] In the tense logic of Prior (1967) and his followers in linguistics (e.g. Dowty 1982), tense is claimed to be an operator. In Prior (1967), Reference time is discarded and only the first two entities and the relation between them are considered sufficient.[2] Focusing on its syntactic representations, others claim tense to be a syntactic feature/ a set of features (e.g. Huddleston 1969; McCawley 1971); and Enç (1987) argues for a sole syntactic referential entity as a primitive.

From the analysis of simple sentences and main clauses, tense is said to have a deictic function (e.g. Reichenbach 1947; Clifford 1975; Lyons 1977; Smith 1981), and its anaphoric nature is noted mainly from the analysis of embedded clauses (e.g. Huddleston 1969; McCawley 1971; Araki et al. 1977; Smith 1981; Enç 1987). Some confine their analysis to single sentences in isolation (e.g. Enç 1987; Hornstein 1990) whereas others (e.g. Weinrich 1977; Smith 1978, 1981; Partee 1984; Declerck 1989) argue for the interpretation of tense in discourse. Regarding the interpretation of tense in embedded clauses, two conflicting proposals have been made: One which endorses the application of the sequence of tense rule (e.g. Costa 1972; Hornstein 1990) and the other which does not (e.g. Reichenbach 1947; Smith 1981; Enç 1987).

Although not much discussed in linguistic literature, intensionality is another aspect involved in the interpretation of tense. As we will see in detail below, Lyons (1977) analyzes tense in simple sentences in terms of the intensional world of a speaker, and Abusch (1988) proposes an analysis of tense in embedded clauses with regard to the intensionality of the matrix verb.

The conventional direction of investigation in linguistics is to seek mapping from morpho-syntactic expressions to semantic or conceptual structure. Here the direction is reversed. We will

first see how we conceptualize time, and then analyze how this conceptual structure is mapped to linguistic expressions via a language particular semantic level, initially in simple sentences and main clauses (hereafter 'simple sentences' for both) and then in embedded clauses. In what follows 'an event' is used for a situation denoted by a proposition.

The present work claims that following from the analysis of the conception of time in section 2, three temporal entities, namely, Speech time(t_s), Event time(t_e) and Cognition time(t_c), and either a simultaneous or an ordinal relation between two of them, should be posited as primitives.[3] Tense is considered here as a notion of a language particular semantic level.[4] It represents a set of temporal configurations each of which consists of a temporal relation of the three terms incorporating the temporal characteristics of an event to be described. Each configuration maps to a morpho-syntactic expression, allowing a one-to-multiple correspondence. All the three temporal entities are regarded as variables to be specified. Extra-sentential elements are included as possible specifiers. In addition to these temporal entities, the speaker and the perceiver or the conceiver (called 'cognizer' here) of a proposition are also considered as primitives and they too are treated as variables to be specified. It is argued that if we take into consideration the cognizer and the speaker of the embedded proposition, the interpretation of tense in embedded clauses naturally follows from the principles for simple sentences.

Based on the proposed hypothesis for an adult's interpretation of tense, acquisition data on the deictic use of past forms of an English-Japanese bilingual girl are analyzed. The implications the acquisition data have on the proposed and competing hypotheses for the interpretation of tense are discussed.

Here, analysis is confined to the temporal relations either simultaneous or anterior to the Speech time. The posterior relations are not included for they involve the modal auxiliary 'will', and the question of whether a structure with 'will' reflects only a temporal relation or the wider notion of possibility under which futurity may be subsumed is still open.

2. The Conception of Time

The conception of time involves the two factors:

A) A relation either simultaneous or ordinal between two or more events, in which the events can be either external or internal.

B) A notion of 'now' or 'present' defined by the conscious perception or cognition of an event by man.

For any linguistic expression, three events are involved:

i) First, there must be an event, such as a dog barking, to be described.

ii) A person must perceive or cognize the event, the barking, in order to talk about it. His cognition is the second event.

iii) Finally, what is cognized is uttered and realized as a linguistic expression. Speaking is the third event.

Each of the three events occurs as a point on a time axis, and they are related either simultaneously or sequentially.

Conceptual analysis suggests that three temporal entities posited corresponding to the three events above, namely Event

time(t_e), Cognition time(t_c) and Speech time(t_s), are necessarily involved in the analysis of natural linguistic expressions. We now look at work explaining the interpretation of tense in terms of three temporal entities.

3. Previous works: Reichenbach(1947) and Lyons(1977)

As mentioned above, Reichenbach (1947) postulates three temporal entities: Speech time (ST), Reference time (RT) and Event time (ET). The 'tenses of verbs' are said to determine the relative temporal order of the three terms. The proposed mapping from the verb forms to the three-term structures are given in (1). (Hereafter symbolically A=B stands for A and B are simultaneous, and A>B for A is posterior to B.)

(1) a. ST=RT=ET present
b. ST=RT>ET present perfect
c. ST>RT=ET past

In (1a) all three points are simultaneous and the relation is realized by a sentence with the present form, in (1b) the Speech time and the Reference time are simultaneous but the Event time is anterior. This is represented by a sentence with the present perfect. In (1c) the Reference time and the Event time are simultaneous and are anterior to the Speech time and the relation is represented by a sentence with the past form. Note that the present perfect is considered as a realization of tense here. We will return to this point later.

Lyons (1977) treats tense from an epistemic point of view and claims it to be a kind of modality. Tense is represented by a relation of three temporal points, each defining a different possible world: A time point at which an event takes place in the extensional world, a time point at which we are asked to look at the extensional world, and a time point of the actual world in which the speaker utters the assertion.[5]

Unlike other previous studies, Lyons (1977; p.821) claims that two temporal relations map to sentences with past forms, and he gives an example of each as in (2) and (3). The example sentences are interpreted as in (2c) and (3c).[6]

(2) a. $t_s=t_c>t_e$ past
b. John was in a quandary.
c. It is a fact that John was in a quandary.

(3) a. $t_s>t_c=t_e$ past
b. It was raining.
c. It was a fact that it is raining.

The normal condition is considered to be as in (2a) where t_s and t_c are identical and it is called primary tense. Relation (3a) on the other hand is said to be a secondary tense which involves deictic projection.

Lyons (1977) does not treat a sentence with the present perfect as a realization of tense. Note that if we disregard the difference between the nature of Reference time and the time point of the intensional world, the configuration mapping to the present perfect in Reichenbach's formulation (1c) maps to the past in Lyons' (3a).

In light of the brief analysis of the conception of time in

the previous section, we adopt the formulations proposed by Lyons (1977) rather than Reichenbach (1947). However, Lyons gives only one example for each structure, and provides no explicit conditions for the different mapping to sentences with past forms. Only tense represented in simple sentences in isolation is analyzed and no reference is made to the specification of the time points.

In the following, we first investigate under what conditions the three temporal terms hold the relationship proposed by Lyons (1977). We focus our attention on the temporal relations between the Cognition time and the Event time, and see how the temporal characteristics of an event interact.

4. The Interpretation of the Past Tense in Simple Sentences and Matrix Clauses

4.1. Possible Temporal Relations between Cognition Time and Event Time

Both Speech time and Cognition time can be reduced to points on a time axis, but more commonly the occurrence of an event takes an interval of time. Following Langacker (1982), the temporal contour of an event is considered as a function of time, $y=f(t)$, where the value of 'y' represents a state 'a' at a given time 't_i'. Temporal characteristics of an event, usually called aspects, vary according to the event in question. It is necessary to clarify which point on a trajectory of an event is simultaneously related to the Cognition time, and under what conditions the ordinal relation holds between them.

The temporal characteristics of an event are often defined as one or quasi one-dimensional contrasts or discrete classes.[7] However, in our analysis they are defined on two orthogonal dimensions: One is the perceived/conceived boundedness, that is whether an event has onset and terminal points, and the other is whether the temporal trajectory of an event is conceived of as constant ($y=a$; where 'a' is the initial value) or not ($y\neq a$). Depending on whether the relation between Cognition time and Event time is simultaneous or ordinal, different dimensions are at issue.

When the Cognition time is simultaneously related to the Event time, i.e. $t_c=t_e$, the dimension of constancy plays a crucial role. If an event is conceived of as constant ($y=a$), then as long as that event takes place, any point of its trajectory can be related to the Cognition time. However, if an event is conceived of as not constant ($y\neq a$), then the point of its trajectory at which one perceives/conceives becomes crucial. In English the onset of an event is simultaneously related with its Cognition time as can be seen in (4).

(4) a. At nine o'clock, John swims in the lake.
b. At nine o'clock, John swam in the lake.

Equating the Cognition time with an internal point between the two end points of a $y\neq a$ event is possible under a marked, progressive form which converts the event to have the property $y=a$. Another marked form, the auxiliary verb 'have' plus a past participle, [$_I$HAVE + P.P.], also represents a $y=a$ event. In the case of a $y\neq a$ event this form represents the final state of the event or its extension (see Langacker 1982), therefore it is

treated as having the property of y=a.[8] Perfects and progressives, accordingly, are treated here as representing a temporal contour rather than a relation between the temporal terms.

When the Cognition time is posterior to the Event time, i.e. $t_c > t_e$, and one is looking back on an event which took place prior to his thinking about it, then only the dimension of boundedness becomes crucial. The event must have an end point, thus an event with a constant contour must terminate in order for its Event time to be posterior to the Cognition time.

4.2. Temporal Relations between the Three Terms and Mapping to Tense

As we have seen, what one cognizes is uttered and realized as a sentence. The two temporal relations between the Cognition time and the Event time therefore must be related to the moment of utterance, resulting in (5).

(5)	a.	$t_s=t_c=t_e$			present
	b.	$t_s=t_c>t_e$	(bounded)	P-configuration	past
	c.	$t_s>t_c=t_e$	(y=a, y≠a)	I-configuration	past

Hereafter, the temporal configuration in (5b) is called the P(erfective)-configuration, and the one in (5c) the I(mperfective)-configuration. In English both the P-configuration and the I-configuration map to sentences with past forms.[9]

Examples in (6) represent the P-configuration. Irrespective of whether the initial state changes or not, they are conceived of as having terminal points. An event is interpreted as terminated, even for progressives, if it is accompanied by an adverbial specifying the interval as seen in (6f).

(6) a. John found the key in the drawer.
b. Mary swam a mile in the lake.
c. Bill swam in the lake.
d. I saw a squirrel on the branch.
e. George lived in London.
f. She was swimming in the lake from 9 to 10 a.m. yesterday.
g. Sue knew the name of the criminal.
h. The robber had blue eyes.

When a simple sentence is presented in isolation, the Cognition time is generally interpreted to be simultaneous with the Speech time. Thus the P-configuration is usually mapped to a sentence with the past form. This is because in order for the I-configuration to be represented, the Cognition time, set in the past, must be specified. (The specification of temporal terms will be discussed in the next section.) The only exception is when the verb is in the progressive form and there is no adverbial to specify the interval. Due to this marked form, the event cannot have a terminal point (see Smith 1983). As seen in (5a) and (5c), the configuration mapped to a sentence with a present form and the I-configuration have the relation $t_c=t_e$ in common. As noted, when an event has a non-constant contour, the $t_c=t_e$ relation forces Cognition time to be set at the initial point. It follows from this that unless the emphasis is on the simultaneity of the Cognition time and the initiation of an

event, y≠a events are not represented by (5a) or (5c), as is often noted in the use of present verb forms. Thus it is very rare for y≠a events to be mapped to the I-configuration in normal discourse. Though rare in normal discourse, the initial point of a y≠a event is freely equated to the Cognition time in narratives in which the focus is on the initiation of an event rather than its termination.

Equating the Cognition time with the Event time is possible in normal discourse, however, provided that the Cognition time is specified as in (7). (The Cognition time of (7f) is situationally specified by the time of the robbery.)

(7) a. At 9 o'clock, John found the key in the drawer.
b. At 9 o'clock, Bill swam in the lake.
c. At 9 o'clock, I saw a squirrel on the branch.
d. At 9 o'clock, she was swimming in the lake.
e. At 9 o'clock, Sue knew the name of the criminal.
f. The robber had blue eyes. (at the time of the robbery)

Note that unlike y≠a events, events with a constant contour can have the Cognition time set at any point on the trajectory as long as it does not terminate. This means that the state existing when the Cognition time is set may still be holding at the Speech time.[10]

4.3. Specification of the Speech Time, Cognition Time and Event Time

Here, all the temporal terms including the Speech time are considered variables to be specified. The specifiers of Speech time are: a) the moment of utterance for general cases, b) a decoding time, or c) in the case of the historical present, direct speech and the complements of verbs of saying in certain analysis (which we will see in the next section), a value for an Event time of a preceding utterance.[11]

Event time is specified by the clause-mate adverbial, either preposed or postposed. The adverbial can be one denoting either a time point or a time interval, depending upon the temporal characteristic of an event. If the Event time is not specified by an adverbial, and if it is related simultaneously to the Cognition time, then this clause-mate Cognition time serves as its specifier. When there is no adverbial and the Event time is not simultaneous with the Cognition time, $t_c > t_e$, then the Event time is given a specific but indefinite value.[12]

Cognition time is specified by the Speech time when they are simultaneous. When they are not simultaneous, it can be specified by an adverbial reducible to a point on the time axis.[13] As suggested by Hornstein (1977), when an adverbial is preposed, it tends to be interpreted as a specifier of the Cognition time. However, as long as it is interpreted as indicating a point rather than an interval, a postposed adverbial can specify the Cognition time.

When there is no such adverbial and the Cognition time is not simultaneous with the Speech time, that is, when the I-configuration is represented, how is the Cognition time specified? Previous works (Clifford 1975; Weinrich 1977; McCawley 1971; Smith 1978, 1981; Partee 1984) suggest a value for an extra-sentential element as the specifier. More precisely, it is either an Event time or a Cognition time of a preceding

sentence. [14] The tendency mentioned above for a preposed adverbial to be interpreted as a specifier of the Cognition time can then be explained in terms of a more general rule: When the I-configuration is represented and there is no postposed adverbial indicating the point on the time axis, the Cognition time is specified by a preceding element.

In addition to these linguistic specifiers, both Event time and Cognition time can be specified situationally, provided that the speaker and the hearer share the same experience. This is the same mechanism as the one for the specification of the Speech time by the moment of utterance or the decoding time. The Cognition time for the narrative past is specified by this mechanism. In this case, the specifier is not the flow of time in the real world shared by the speaker and the hearer but instead the imaginary flow of time created by the text.

Table 1. Variable specifiers for Speech time, Cognition time and Event time (situational specifiers for t_c and t_e are excluded)

Speech time		The moment of utterance for general cases; Decoding time; t_e of a preceding context for the historic present, direct speech, complements of verbs of saying
Cognition time	$t_s=t_c>t_e$	The clause-mate t_s
	$t_s>t_c=t_e$	An adverbial reducible to a point on the time axis; t_e or t_c of a preceding context; Imaginary flow of time for the narrative past
Event time	$t_c=t_e$	A clause-mate t_c or a clause-mate adverbial
	$t_c>t_e$	A clause-mate adverbial

4.4. The Deictic Nature and the Anaphoric Nature of Tense

When the moment of utterance of a simple sentence specifies the Speech time of the sentence/clause in question, the Speech time always bears an absolute value. While if it is specified by other values, the specification is indirect and may or may not take an absolute value. The deictic nature of tense is attributed to the Speech time being directly specified by the moment of utterance and the other terms being related to it transitively.

In general cases, that is, when the Speech time is specified by the moment of utterance, the anaphoric nature of tense is attributed to the Cognition time being specified by an Event time or a Cognition time of a preceding context. When the Speech time is specified by an Event time of a preceding context, it also serves as the bearer of the anaphoric nature of tense.

4.5. Specification of the Speaker and the Cognizer

As we have seen in section 2, the Cognition time and the Speech time are respectively, the time points at which a person cognizes an event and utters what s/he has cognized. The question then arises: who are the cognizer and the speaker? For simple sentences, the speaker of a sentence is always the speaker of the utterance in question except for the case of direct speech. When the speaker of the utterance perceives or witnesses the event to be described, there is no doubt that the cognizer is also the speaker of the utterance. In English, when the speaker describes an event based on his/her knowledge, or cognition obtained from others, the cognizer is also said to be the speaker of the utterance.[15] However, as we will see below, the speaker and the cognizer of an embedded clause may differ from the speaker of the utterance.

5. The Interpretation of Tense in Embedded Clauses

In this section, we will see that the interpretation of tense in finite embedded clauses follows from the principles we have seen for simple sentences. In the analysis, identification of the speaker and the cognizer of an embedded clause plays a crucial role.

It has been noted that the interpretation of tense differs for relative clauses and complement clauses (Huddleston 1969; Ota 1973; Araki et al. 1977; Smith 1981; Enç 1987). In the sections to follow we look at this difference and proceed to see if the theory proposed by Hornstein(1990), which is based on Reichenbach (1947) properly explains this difference. It is argued that the present principles proposed for simple sentences account for the interpretation of tense in embedded clauses. Here only the case in which both the matrix and embedded clauses are with past forms is analyzed.

5.1. Structural Differences Reflected in the Interpretation

Examples below show the differences in interpretation among the relative clauses (8), complements of verbs of thinking (9) and verbs of saying (10) with or without adverbials specifying the Event time of the matrix clause and the embedded clause.

(8) a. John talked to the boy who was crying.
b. Yesterday [=Friday], John talked to the boy who was crying {i. on Monday. / ii. this morning.}
c. John talked to the boy who is crying.

(9) a. John thought that the boy was crying.
b. Yesterday [=Friday], John thought that the boy was crying {i. on Monday. / ii. *this morning.}
c. *John thought that the boy is crying.

(10) a. John said that the boy was crying.
b. Yesterday [=Friday], John said that the boy was crying {i. on Monday. / ii. *this morning.}
c. John said that the boy is crying.

As seen by the co-occurrence of adverbials in (8b) relative clauses allow any ordinal relation between the matrix Event time and the embedded Event time, and when there are no adverbials as in (8a), the two Event times tend to be interpreted as simultaneous. Note that relative clauses can be with present forms as well (8c).

Unlike relative clauses, complements of verbs of thinking, as well as verbs of saying, cannot take the embedded Event time posterior to the matrix Event time as seen in (9bii) and (10bii). Complements of verbs of thinking never allow the present verb forms to be within a matrix clause with a past form as in (9c), whereas, those of verbs of saying do allow the present forms to be as in (10c) under certain conditions. In both types of complements, when no adverbial specifies the embedded Event time as in (9a) (10a), the matrix and embedded Event times tend to be interpreted as simultaneous as in relative clauses.

5.2. Problems with the Theory of Hornstein(1990)

Hornstein (1990) adopts Reichenbach's (1947) framework: The finite embedded clause, as well as the matrix clause, is rendered Speech time, Reference time and Event time and the interpretation of tense in embedded clauses is given by an optional application of the sequence of tense rule (SOT). This SOT rule associates the Speech time of the embedded clause with the matrix Event time. The rule is applicable only when the 'INFL' of the embedded clause is governed by the matrix verb, thus avoiding its application to relative clauses.

Note that his theory fails to explain the following points:
1) The tendency for a relative clause to be interpreted as simultaneous in (8a). This is due to the inapplicability of the SOT rule to relative clauses. Unless the SOT rule applies, the Event times of the embedded and matrix clauses are not related to each other.
2) The unacceptability of examples (9bii) and (10bii). This is due to there being no constraints on the temporal relation between the two Event times when the SOT rule does not apply.
3) The unacceptability of a present verb form in a complement of verbs of thinking as in (10c). As the SOT rule applies optionally to complement clauses, when it does not apply, such sentences are freely generated.[16]

5.3. Possible Temporal Combinations

We now turn to see how the principles proposed above for simple sentences explain the interpretation of tense in embedded clauses. For simple sentences the speaker and the cognizer are always the speaker of the utterance. However, the cognizer and the speaker of an embedded clause can be different from the speaker of the utterance. According to the identification of the cognizer and the speaker of the embedded clause, the possible temporal relations between the matrix and embedded Event times vary. It will be argued that when the embedded clause is within the scope of the intensional predicate, the denotatum of the matrix subject (hereafter matrix Subject) serves as the cognizer of the embedded event. The speaker and the cognizer of the complements of verbs of saying are the matrix Subject except for

the cases where the content of speech is re-analyzed by the matrix speaker.

Although a matrix clause can represent either the P-configuration ($t_s=t_c>t_e$) or the I-configuration ($t_s>t_c=t_e$), in the analysis to follow only the cases in which the P-configuration is represented are considered since the resulting temporal configurations do not differ in points which have relevance to the present discussion.

5.3.1. Matrix Clause Speaker Identical to Embedded Clause Speaker/Cognizer: the Relative Clause

First we will look at the case in which the matrix speaker is also the speaker and the cognizer of the embedded clause. In this case the principles for simple sentences directly apply to both the matrix clause and the embedded clause. Table 2 shows the possible combinations of temporal configurations mapped onto matrix and embedded clauses. The temporal relations between the matrix Event time (T_e) and the embedded Event time (t_e) are given in the intersecting cells. (Capital T's represent matrix temporal terms, and * stands for any possible relation.)

When all the temporal terms of an embedded clause are related simultaneously, the matrix Event time precedes the embedded Event time as shown in intersecting cell A. When the embedded clause is represented by the P-configuration, the Event times of two clauses are specified independently, thus the temporal relation between the two can exhibit any relation depending on the values of the specifiers (cell B).

Table 2. Matrix speaker/cognizer identical to Embedded speaker/cognizer [condition: $T_s=t_s$]

	Embedded clauses		
	$t_s=t_c=t_e$	$t_s=t_c>t_e$ P-conf.	$t_s>t_c=t_e$ I-conf.
Matrix clauses $T_s=T_c>T_e$ P-conf.	A: $t_e>T_e$	B: T_e*t_e	C-1: ($t_c=T_e$) $T_e=t_e$ C-2: ($t_c\neq T_e$) T_e*t_e
Verb forms realized	present	past	past

* stands for any temporal relation

When an embedded clause represents the I-configuration, its Cognition time must take a value other than the Speech time. Note that the matrix Event time is a possible specifier for the embedded Cognition time. Cell C-1 shows the case when the matrix Event time serves as the specifier, just as an Event time of a preceding context does for a simple sentence. Here, the matrix and the embedded Event times take the same value, and thus are

simultaneous. If the embedded Cognition time takes other specifiers such as an adverbial or an extra-sentential element, then the relation between the two Event times cannot be decided as in C-2. The verb forms realized by the mapping of embedded configurations are shown in the bottom row of the table.

Generally, the cognizer of an event described by a relative clause is the speaker of the matrix clause. There is a case, however, in which the cognizer is not the matrix speaker but a matrix Subject. We will return to this shortly.

In a general reading, the cognizer of a relative clause as in (8) is the matrix speaker. The interpretation of tense for examples in (8) can then be explained by the combinations in Table 2, in which all relations between the two temporal configurations, and between the two Event times are allowed. The embedded clause in example (8a) has a past progressive without an adverbial, therefore, is forced to represent the I-configuration. This results in it holding the relation as in C-1, and giving the simultaneous reading. The preposed adverbial 'yesterday' in (8b) specifies the matrix Cognition time (thus the Event time as well), however, what the postposed adverbial 'Monday' actually specifies is ambiguous. If it specifies an interval, then the embedded clause represents the P-configuration, and thus results in cell B. If it specifies the embedded Cognition time, then the C-2 combination is realized. In both cases, the values of the specifiers decide the final relation, thus $T_e > t_e$ for (8bi) and $T_e < t_e$ for (8bii). Since the embedded Speech time is directly specified by the moment of utterance, any configurations/verb forms, including $t_s = t_c = t_e$/present forms, are allowed, and thus resulting in the acceptability of (8c).

5.3.2. Matrix Clause Speaker not Identical to Embedded Clause Cognizer: Complements of Verbs of Thinking

Now consider the possible combinations of the temporal configurations when a matrix speaker cannot be the cognizer of the embedded clause. Note that on-going subjective thoughts of an individual are not accessible to others. Thus the cognizer must be the one actually thinking. This means that the complements of verbs of thinking, which express the contents of thoughts, must have the matrix Subject as their cognizer.

The contents of on-going thoughts are not usually verbalized. Therefore, no speaker is involved for the embedded clause, which leads us to disregard the embedded Speech time. The Cognition time of a thought must be simultaneous with the time of a mental process. This means that the embedded Cognition time must be simultaneous with the matrix Event time. This results in a linear transitive relation for the terms involved. Table 3 shows the possible combinations.

In a general reading, the cognizer of the complements of verbs of thinking is the matrix Subject. The simultaneous reading of example (9a) is given by cell A, and example (9bi) in which the embedded event precedes the matrix event, by cell B. Although the progressive form with an adverbial is used in (9bi), the event must be conceived of as bounded, for it is not possible for the embedded Cognition time to be anterior to the matrix Event when the former is specified by the latter. If the content of a thought refers to a future event, a different configuration, $t_c < t_e$, which maps to a structure with 'would', is

necessary. Prohibition of the present form for (9c) follows from the fact that the embedded Cognition time must be specified by the matrix Event time.

Table 3. Embedded cognizer specified by the matrix Subject (no speaker for the embedded clause) [condition: $T_e=t_c$]

	Embedded clauses	
	$t_c=t_e$	$t_c>t_e$ (bounded)
Matrix clauses $T_s=T_c>T_e$ P-conf.	A: $T_e=t_c=t_e$	B: $T_e=t_c>t_e$
Verb forms realized	past	past

It must be mentioned here that in certain readings, relative clauses represent the configurations in Table 3 as well. These are when only the matrix Subject is the cognizer (see Abusch 1988).

5.3.3. Matrix Clause Speaker not Identical to Embedded Clause Speaker: Complements of the Verbs of Saying

Another case in which the embedded cognizer differs from the matrix speaker is when the embedded speaker is specified by the matrix Subject and consequently the embedded Speech time is specified by the matrix Event time. As seen in Table 4, all the terms of the matrix and embedded configurations are transitively related.

Table 4. Embedded speaker specified by the matrix Subject [condition: $T_s\neq t_s$ & $T_e=t_s$]

	Embedded clauses		
	$t_s=t_c=t_e$	$t_s=t_c>t_e$ P-conf.	$t_s>t_c=t_e$ I-conf.
Matrix clauses $T_s=T_c>T_e$ P-conf.	A:$T_e=t_e$	B:$T_e>t_e$	C:$T_e>t_e$
Verb forms realized	past	[$_p$HAVE+ED + P.P.]	[$_p$HAVE+ED + P.P.]

The structures representing these combinations of configurations are the complements of verbs of saying, in which one reports an utterance of another or his/her own. Before we proceed to see how the interpretations of the examples in (10) are derived, further analysis of the complements of verbs of saying is necessary.

Suppose the quotation in example (11) is the original speech. A report of this speech can be made either by direct speech (11) or by indirect speech (12)(13). In example (12) the matrix speaker intends to report the original speech as it was, but in example (13) the matrix speaker reports the original speech in his/her own words. Call these the D-type and R-type indirect speech, respectively.

(11) Direct speech
  a. John said, "The boy is crying continuously."
  b. John said, "The boy was crying continuously."

(12) D-type indirect speech
  a. John said that the boy was crying continuously.
  b. John said that the boy had been crying continuously.

(13) R-type indirect speech
  John said that the boy kept crying.

The speaker of the embedded clause for both the direct speech and the D-type indirect speech is the matrix Subject and the embedded Speech time is identical with the matrix Event time. Thus they each represent combinations of the configurations in Table 4.

As seen in (11a) and (12a), the original speech is with the present form for direct speech while it is with the past form for the D-type indirect speech. (A similar contrast is observed between (11b) and (12b)). According to the mode of report, the same configuration maps to different linguistic expressions. How can this be explained?

In both examples (11a) and (12a), the configuration $t_s=t_c=t_e$ (hereafter the S(imultaneous)-configuration) represents the reported speech. However, they differ in the following respect. In direct speech, the original speech is presented to the hearer as if s/he too was one of the original addressees. In order for this impression to be formalized, we need to introduce a forth temporal term, that is the Decoding time(t_d). Combinatorial configurations in (14) show how the Decoding time is related to the embedded Speech time.

(14) a. Direct speech:
$T_s=T_c>T_e$ & $t_d>t_s=t_c=t_e$ [where $T_s=t_d$, $T_e=t_s$]

  b. D-type indirect speech:
$T_s=T_c>T_e$ & $t_d=t_s=t_c=t_e$ [where $T_s>t_d=t_s$]

  c. Simple sentences/matrix clauses:
$T_d=T_s=T_c=T_e$ [$T_d=T_s$:the moment of utterance]

The Decoding time of the embedded direct speech clause is at

the matrix Speech time, while that of the embedded indirect speech clause is at the matrix Event time. When the S-configuration maps to a simple sentence, the Decoding time is at the utterance time. The different mapping derive from the relation the Decoding time holds to the matrix Speech time (as seen in the contrast of (14a) with (14c)), and also from whether the Decoding time is specified by the matrix Event time or not (as seen in the contrast of (14b) with (14c)).

Now let us turn to the analysis of the R-type indirect speech. Example (13) is the case in which the reporter reconstructs the content of the original speech. In this case the speaker of the embedded clause is no longer the original speaker but the matrix speaker, and the structure too must be re-analyzed to reflect this. The temporal configurations mapping to R-type indirect speech are the same as those shown in Table 2.

However, a caution is necessary. Not all the combinations in Table 2 are permissible, because what is reported by the matrix speaker must be first uttered by the original speaker and the reconstruction should not contradict with what the original speaker said. Hence the constraint on the reconstruction/re-analysis (hereafter 're-analysis') is necessary.

Condition: In proceeding with the re-analysis, retain the value specifying the original speaker (thus the cognizer as well), the Speech time, the Cognition time, and the original configuration. The product of re-analysis should not contradict with the original values and configuration.

This constraint excludes the possibility of the embedded Event time being specified by a value posterior to the embedded Speech time while retaining the original configuration. The re-analysis allows a present verb form to be in the complement so long as the event is cognizable to the matrix speaker.

We now turn to see how the interpretation of the examples in (10) are derived. There are two possible combinations that map to (10a): If this is interpreted as the D-type indirect speech, the embedded clause is then represented by the S-configuration in Table 4, and the relation in cell A yields a simultaneous reading. If it is interpreted as the R-type indirect speech, then either the P-configuration or the I-configuration in Table 2 represents the embedded clause. If the I-configuration is represented, and the Cognition time is specified by the matrix Event time (C-1), then a simultaneous reading is derived. Because of the constraint on the re-analysis, the relation $t_e > T_e$ is excluded, leaving only the relation $T_e \geq t_e$. This gives the interpretation of the matrix event being either simultaneous or posterior to the embedded event.

Example (10bi) has both the matrix and embedded Event times specified, with the embedded Event time preceding the matrix Event time. For this relation to be expressed by the D-type indirect speech, the embedded clause must be with [$_p$HAVE+ED +P.P.]. The embedded clause in (10bi) is with the past form, therefore it is represented by the P-configuration in Table 2. Here again because of the constraint only the relation $T_e > t_e$ is permissible, which explains the unacceptability of (10bi'). The complement clause with the present form seen in example (10c) is allowed because of the re-analysis.

We have seen that the principles proposed for simple sentences account for the different interpretations observed for

relative clauses, and complements of verbs of thinking and saying. Analysis suggests that the complements of verbs of thinking and saying must be treated differently. It reveals that the interpretation of tense in embedded clauses naturally follows from the principles for simple sentences if the identification of the embedded speaker and the cognizer is taken into consideration.

6. Acquisition

We now turn to the acquisition data of an English-Japanese bilingual girl, with regard to her use of past forms, and see what they lend to the hypothesis proposed. The results of the analysis will be discussed in light of the acquisition theory proposed by Weist(1986, 1989). It will be argued that a problem arises if the Reichenbachian framework upon which Weist's (1986) theory rests is adopted, whereas the principles proposed above explain the acquisition data more naturally.

The study reported here is part of a project conducted by an Ochanomizu University research group headed by Noriko Imanishi, of which I was a member.[17] The group recorded spontaneous speech samples of an English-Japanese bilingual girl, called Mary, from age 2:5 until 4:8.[18] Only the English data from age 2:5 to 4:4 are referred to here. In her detailed analysis of Mary's syntactic development in both languages until age 3:4, Imanishi(1987-88) notes that the relative orders in which Mary acquired the structures of each language are no different from those of a mono-lingual child. (See Appendix A for the description of the child and the data collection procedure.)

We seek to answer two questions in analyzing Mary's acquisition data: 1) Is there any developmental difference between the mapping of the P-configuration and the I-configuration? 2) In what order, if any, are the mapping of the two configurations to sentences with past forms acquired: The P-configuration first, or the I-configuration first, or simultaneously? If the mapping of the P-configuration precedes, then the often cited, but controversial tendency of children to distinctively mark completed actions with the past forms in their early phase of development can be explained without claiming that the past forms only mark aspectual distinctions and lack deictic function.[19] In what follows we analyze Mary's spontaneous speech samples for any data that substantiate a difference in the mapping and give evidence of their relative order of acquisition.

6.1. The Initial Use of Structures Requiring the Mapping of the I-configuration

We will first look at the initial use of structures in the samples requiring the mapping of the I-configuration to a sentence with the past form. As we have noted, a structure represents the I-configuration when a preceding contextual element sets a Cognition time. The structures which uniquely represent this configuration are those structures with 1) a past progressive without an adverbial specifying an interval, 2) an auxiliary verb 'be' plus ' going to' used in the past forms, 3) a preposed adverbial referring to a time point in the past, and 4) complements of verbs of thinking. Mary's first use of such structures in the samples are given in (15) through (21) in

chronological order, where C, M, and X stand for child, mother and observer, respectively.[20]

The first use of the past progressive in the sample was at age 2:10 as in (15).

(15) a. M: She [=doll] is Mary, I see
C: She is hiding with xx
This is my xx and elephant was hi hiding
M: Elephant was hiding?

b. M: One for the doll and the elephant too
C: Today, today, today elephant was sleeping [2:10]

The samples in (15) are spontaneous comments in pretend play. They are spontaneous in the sense that there is no previous linguistic or situational context that sets the Cognition time in the past. In (15a) there is no such tontext to set the Cognition time. In (15b) an adverbial 'today' is preposed. From this utterance, it is not clear whether 'today' is meant to set the Cognition time in the past or to specify an interval. In adult grammar, 'today' is not reducible to a point, and even if it is preposed, it needs further specification of a time point in order to serve as a specifier of the Cognition time. These utterances suggest that either the Cognition time is set only in her mind, or that these events are conceived of as having been terminated. Further study is necessary to clarify this point. For the present purpose, however, suffice it to note that a possibility of a representation of the I-configuration was observed at this age.

It was at age 3:2 that the past progressive with a required preceding linguistic context was observed (16). At 3:6 it was used productively (17).

(16) C: I had a little book I was xxing [3:2]

(17) a. X: I've been nice.
C: You were fighting with the girl, girl, because I was seeing you (we)er not sleeping [3:6]

At age 3:5, establishment of the Cognition time by the preposed adverbial clause led by 'when' was observed as in (18).

(18) C: When I was a baby I didn't do anything
When I was a baby I just ate cereal and ... mashed potatoes [3:5]

Beside the problematic use of 'today' in (15b), the use of a preposed adverbial to specify the time point in the past was first observed at 3:6 (19). Note the contrast in the sample at age 3:3 given in (20) where the preposed adverbial 'one time' is followed by a clause without the past marking.

(19) C: Remember, last time I was wearing it? [3:6]

(20) C: One time we need to wait ... Because everyone ride on Dumbo That's why we waited
(portion of conversation in (28)) [3:3]

Shown in (21) is the use of the auxiliary verb 'be' in the

past form plus 'going to' first observed at age 3:7. Thereafter it was used frequently.

(21) C: Oh who is knocking on the door? I was going to sleep [3:7]

At age 3:7 a complement of the verb 'think' was used also with the past verb form as in (22) line 3. There had been only one previous instance at 2:11, seen in (23), where she used the matrix verb 'think' in the past form, but then the complement was not with the past form.

(22) 1 C: Who are you?
X: I'm Charlie Brown.
2 C: Oh, but I didn't know that
X: You know, you know me, you don't know me?
3 C: No But I thought you were lion [3:7]

(23) C: I thought you are going to teach [2:11]

Samples in (24) at age 3:10 show complements of the verb 'know' embedded under a matrix with the past form.

(23) a. C: I didn't know why it was a tiger [3:10]
b. C: Oh, I was, I was losing you I didn't know you were coming and get me [3:10]

After the age of 3:10 no new use of the structures relevant here was observed.

We have now seen in the samples the first use of structures representing the I-configuration which requires the Cognition time to be set previous to the Speech time. These structures, except for the past progressives, all appeared gradually during the period of 3:5 through 3:10. As noted, the past progressives without a required linguistic context were first observed at 2:10, and with it at age 3:2.

6.2. Four Citations from Samples before 3:5 to Support the Earlier Acquisition of the P-configuration

The structures we have seen so far all involve elements which add complexity to the total structure. Therefore, it is necessary to look into the use of the past forms before age 3:5. The structures analyzed above all require the mapping of the I-configuration. The analysis of the rest of the samples requires estimation of how Mary conceptualized the events she talked about, and therefore involves complexity. As the detailed analysis is still in progress, only a few points can be tentatively made here. There are some data, however, that suggest that the mapping of the P-configuration to sentences with past forms precedes that of the I-configuration, at least in a productive way.

Let us first see Mary's use of past forms. According to Imanishi (1987-88) the following points are observed through age 3:4: When the data collection of Mary's spontaneous speech started at age 2:5, all the verbs observed were in root forms (3; 110).[21] From 2:6 to 2:7 the use of the present forms for the third person singular became stable, but the use of past forms was restricted to a few irregular verbs (found, had, did) and in

many cases verbs were used in the root forms (4; 111). At 2:8, the first marking with the -ed inflection was observed in the utterance "I spilled" (5; 99). At 2:9 a use of 'was', a past form of the verb 'be', was observed. Although irregular past forms gradually appeared, regular -ed inflection was still absent in some required contexts (6; 95). From 2:10 to 2:11, to a considerable extent, both regular and irregular past forms were used to indicate an action completed. Structures mentioned are: We forgot curry/ You went to the park/ I turned (on) cold water / I did take you home/ I did pour any tea/ You didn't drink milk (excerpted from Imanishi (1987-88)(7; 50; 179-181)). At the end of 2:10 and the beginning of 2:11, past forms were used in the form of 'did' plus the root forms, for both regular and irregular verbs (7; 53).[22]

We turn to see the data that suggest the early mapping of the I-configuration. As seen before, the Cognition time cannot be set in the past without a specifier in the previous context, or a clause-mate adverbial indicating a time point in the past. First, it should be mentioned that no use of adverbials of this kind was observed until 3:5. The exceptional cases were the use of 'today' and 'one time' seen in (15 b) and (20). However as noted, the verbs in sample (20) were not in the past forms.

The second point is that the majority of the utterances with the past forms before age 3:5 were her spontaneous comments on past events without any preceding linguistic or situational context referring to past events. The events described are y≠a events except for a few cases mentioned below. As noted by Imanishi (1987-88), the earliest deictic use of y≠a event verbs are: found, had, did, forgot, [2:7]; spilled [2:8]; opened [2:9].[23]

As noted previously, the mapping of the I-configuration to a y≠a event rarely occurs even in adult speech except for the narrative past. This, together with the fact that spontaneous comments do not have a preceding context to set the Cognition time in the past, means that spontaneous comments describing y≠a events are very likely to represent the P-configuration. As noted by Imanishi (1987-88), by age 2:11 the number of new verbs representing y≠a events was increased and at this age the mapping of the P-configuration to sentences with past forms was productive. Occasional absence of the past marking was observed for these spontaneous comments describing y≠a events until 3:5.

An early spontaneous comment describing a y=a event is the utterance with 'had' in (16) at age 3:2.[24] The structure itself does not tell which configuration is represented by the sample. If the I-configuration maps to it, the Cognition time must be specified by a situational context. Or as in the case of the earliest use of the past progressive, Mary might have set it in her mind.

It is not clear whether the second utterance in sample (25) should be treated as a spontaneous comment or not.

(25) C: I opened
It was like this [noise of handling paper]
[2:9]

The first one is spontaneous, uttered in pretend play referring to an imaginary wrapped candy. Although which configuration is actually represented by the second utterance is ambiguous, there is a possibility for the I-configuration to be represented. Note

that the verb used is the copula verb 'be' in the form of 'was'. We will return to this point later.

The third point comes from the analysis of utterances following the introduction of a topic referring to a past event. It was at age 2:9 that such conversation was first observed. In (26) Mary described what happened to her table one morning. In this sample however, the verbs are either omitted or not in the past forms.

(26)
M: Would you like to sit at the table?
C: No, it ... no ... orange
M: It's for what?
C: Orange
M: Orange? Oh it's full of orange?
C: I spill out
M: You spilt out? Did you spill juice on it?
C: Yeah, tissue paper and, and I dirty
M: Oh did you. Tissue paper in what? What did you put tissue paper in, Mary?
C: Juice
M: In the juice and then?
C: And then clean the table
M: And then cleaned the table with the tissue paper.
C: And it get dirty [2:9]

Here she is trying to explain in order what she witnessed. She is aware that the events took place in the past, preceding the utterance time. What (26) suggests then, is that the I-configuration is conceptualized but it is not represented by the appropriate linguistic expression.

In another conversation at this age, past forms are used as in (27).

(27)
M: Who else came today?
1 C: Sharon didn't come
M: That's right, Sharon didn't come.
2 C: Sick
M: Sick, yeah, she probably was sick. Who else did come?
3 C: Vicky was there
M: Vicky was there, that's right. [2:9]

In this sample the copula verb 'be' and the auxiliary verb 'do' are in the past forms. Note that in this conversation Mary is answering the questions. We will return to this sample in the next section where we analyze replies to questions asked with past forms.

Dialogue (28) is a conversation between Mary and her mother about their visit to Disneyland at age 3:3.

(28) a.
M: It rained that afternoon so they didn't have a parade
1 C: That's right He [=Mickey Mouse] stays in his home
M: What we saw was the Mickey Mouse review. Yes, and we did see him. Didn't shake his hands but we did see him.
2 C: And Minnie Mouse and Pooh and Piglets

M: Minnie Mouse and Pooh and Piglets and everybody That's interesting.
3 C: And Goofy
M: Goofy too?
4 C: And xx?
M: You didn't see him?
5 C: Mr. Robin
6 But we didn't see Mr. Robin
X: Did you ride on the Dumbo?
7 C: One time we need to wait
M: We had to wait.
8 C: Because everyone ride on Dumbo
9 that's why we, we waited
10 we wait and wait and wait and wait

b. M: Did you enjoy the ride around [=merry-go-round]? You have to wait a long time for that, too, I think.
11 C: We saw that at Koorakuen [=amusement park]
M: Koorakuen?
12 C: Koorakuen And Mummy didn't go Just Mary and Dad [3:3]

Notice that though Mary uses the past forms in a context referring to a past event as seen in lines 6, 9, 11, 12, the verbs are not in the past forms in lines 1, 7, 8, 10. The same verb 'wait' is marked in line 9, yet not in line 10. After this sample, it was next at age 3:5 that a conversation concerning past events was observed. Even then some verbs were not in the past forms. Thereafter, such conversations became more frequent, and by age 3:10, Mary could engage in pretend play, setting the main event of the play in the imaginary past and carrying on a conversation referring to it throughout the play.

At age 4:4 in the elicited conversation presented in Appendix B, she narrated a short skit presented in a video. She started to narrate the main events of the scene after being prompted by her mother's question. Her narration of the events suggests that even representing y≠a events with the I-configuration was possible at this age.

The fourth point regards responses to questions with past forms, hereafter referred to as the 'question'. Analysis of the response to a question is rather troublesome, because even though the question is with a past form it does not seem to force a response representing the I-configuration. So it is difficult to know which configuration the child has conceptualized. The analysis presented here is therefore tentative.

At age 2:5 Mary gave correct answers to questions but not with the past forms as seen in (29).

(29) M: What did you do with Haruto [=boy's name] yesterday, Mary?
C: A...pay [=play]
M: What?
C: Pay
M: Play?
C: Play
M: What did you play with?
C: Cayons

M: What?
C: Cayons
M: Crayons, that's right, crayons. You played with crayons xx Haruto, didn't you. [2:5]

The first replies with the past forms were observed at 2:9, as we have seen in sample (27). Subsequently, at 2:10 samples (30) to (32) were observed.

(30) M: What did Cresta do today?
C: She did, she did, she did, she did eat cookies
M: She did eat cookies?
C: She didn't xx cookies [2:10]

(31) M: You went into the woods with Taisuke [=boy's name], didn't you? At Karuizawa [=name of a resort area]. Do you remember? You played in the woods?
C: Taisuke was not there, right? [2:10]

(32) M: Who wrote on it?
C: Monster
M: Do you think it was the monster?
C: Yeah
M: Bad monster, isn't it?
C: No, it was xx
M: What?
C: It was baby monster [2:10]

The configuration representing these utterances is ambiguous. The event described in sample (30) is a y≠a event, therefore it is very likely that the P-configuration is represented.

Recall that the verbs used in (27) are 'didn't come' and 'was'. Note that the verbs used in the past forms in samples (31) and (32) are also the copula verb 'be'. Interpreting from the contexts and the use of the verb 'be' indicating a state, the utterances in (31) and (32) very likely represent the I-configuration. The analysis of the interpretation of tense when a proposition is negated as in (27) and (31) needs further investigation.[25]

6.3. P-configuration Preceding the I-configuration in Productive Mapping

What does the analysis above suggest for the order of acquisition of the mapping to the appropriate linguistic expressions for the P-configuration and the I-configuration? Analysis of Mary's spontaneous comments has revealed that the mapping of the P-configuration to sentences with past forms was first observed at 2:7. Three different verbs in the past forms were observed to be in use at this time. Thereafter, the number of her new verbs increased gradually, and the mapping of the P-configuration to sentences with past forms became fully productive at age 2:11.

The cases in which mapping of the I-configuration to sentences with past forms is possible were first observed at 2:9.

The analysis of her spontaneous comments, conversation on a topic referring to a past event, and replies to questions with past forms suggest that early mapping was restricted to the copula verb 'be' in the form of 'was'. She used the 'was' in some instances during the period 2:9 to 2:10 but after this no productive use was observed until 3:5. She also used the past progressive with an auxiliary verb 'be' in the form of 'was' at 2:10, but then without any situational or linguistic context to specify the Cognition time. At 3:2 (sample (16)) a linguistic context was supplied. Different verbs other than 'be' began to be used in conversation at 3:3. These findings suggest that the onset of the mapping of the I-configuration to sentences with past forms was later than the mapping of the P-configuration. It began to be productive at 3:2 to 3:3 and was fully productive at 3:5 to 3:6. This was again later than that of the P-configuration.

We have seen the data on Mary analyzed in terms of the principles proposed earlier for an adult's interpretation of tense. The analysis suggests that developmentally there is consistent difference between the mapping of the P-configuration and the I-configuration to sentences with past forms. This supports the claim that two separate configurations map to sentences with past forms.

7. Discussion

7.1. The Theory of Weist (1986, 1989)

Let us now turn to the theory of acquisition of tense proposed by Weist(1986, 1989), and see if the analysis presented here conforms to his theory. It should be noted that Weist(1986) adopts Reichenbach's framework, which posits the Speech time(ST), the Reference time(RT) and the Event time(ET). Recall that it claims that sentences with the present perfect are treated as representing the temporal configuration, ST=RT>ET.

Investigating cross-linguistic acquisition data as well as his own on Polish, Weist(1986, 1989) proposes a hypothesis, in which he claims that children progress through a sequence of four temporal systems. An initial temporal system is called the Speech time (ST) system, where RT, and ET, are frozen at ST. Speech time is the only functional time concept at this stage, and only the distinction between statements and requests is expressed.

The second system, called the Event time (ET) system, allows the ET to be ordinal to ST while RT remains frozen at ST. Children begin to express the deictic relationship between ST and ET, as well as the aspectual distinction between internal and external perspectives of situations. The past verb forms begin to be used at this stage.

The concept of Reference time becomes functional in the third temporal system, which is called the restricted Reference time system. The restricted Reference time system allows RT to be shifted away from ST. Reference time is defined as the temporal context for an event. It either remains at ST or incorporates the time of the event. The system is characterized by the onset of the use of temporal adverbs and temporal adverbial clauses, and also by the absence of temporal prepositions signifying 'before' and 'after'. In the fourth, the free Reference system, ST, ET and RT can represent three

different points in time and can be related freely.

What Weist means by 'remain frozen' is not very clear. In Weist(1989) he states concerning the Speech time system, "Initially children code events as if they occurred during the Speech time interval, and the child's point of temporal reference is also at Speech time." (Weist, 1989; p.66) Reasoning from this, RT 'frozen' at ST means RT at the same point with ST.

Now let us see if the order of acquisition Weist(1986, 1989) proposes conforms to our analysis. As Weist's notion of Reference time differs from our notion of Cognition time, and he infers children's temporal concepts from linguistic expression, whereas the approach taken here is the reverse, the two hypotheses make different claims if compared in detail. However, it suffices now to note that the following two points are in accordance. First, children map two different temporal configurations to sentences with past forms. (In Weist's(1986, 1989) theory this happens sequentially in the course of development, whereas the claim here is that the two different mapping coexist even for an adult, as we will argue in detail below.) Second, the temporal configuration children first map to sentences with past forms is the one in which the Reference time or the Cognition time is set at the Speech time.

7.2. Reichenbach's Theory Examined in Light of Acquisition Data

If we try to explain this general order of acquisition within the framework of Reichenbach's theory, a problem arises. Notice that in the Event time system, the Reference time is at the Speech time and the Event time itself is placed prior to both, i.e. ST=RT>ET. As we have seen earlier, this temporal configuration corresponds to a sentence with the present perfect in the Reichenbachian framework. This means that children first map this temporal configuration to sentences with past forms, and when they proceed to the third restricted Reference time system, the mapping established in the second system is abandoned, because in the Reichenbachian paradigm, only the temporal configuration, ST>RT=ET, which emerges in the restricted Reference system corresponds to sentences with past forms. They establish the mapping for the present perfect still later.

Weist(1986, 1989) avoids this complexity of mapping by claiming that the present perfect is acquired in the third system, when children become capable of shifting the Reference point. But as long as Reference time is said to 'remain' at ST, this is not very convincing. In Weist(1986), after admitting that RT remains frozen at ST, in the second system, he states, that the concept of Reference time emerges in the third system. These statements seem contradictory, but if we accept the concept of Reference time emerging only in the third temporal system, the second ET system must lack this concept, thus as Smith(1980) claims only ET is related to ST. In this case, however, a child's grammar does not conform to an adult's.

These complexities derive from the Reichenbachian notion of 'Reference time', and are also due to letting the temporal configuration, ST=RT>ET, map to sentences with the present perfect. The hypothesis for the interpretation of tense proposed here avoids these complexities. It simply claims that a child acquires the mapping of the temporal configurations in order. Not only that, as the temporal configurations incorporate aspectual distinctions, the hypothesis here also accounts for the

aspectual distinctions children make in acquiring past forms.

8. Summary and Conclusion

The analysis of the adult's interpretation of the past tense seen in sections 2 through 5 has led us to postulate the following hypothesis: Speech time(t_s), Cognition time(t_c) and Event time(t_e), are the primitive temporal terms. Each of them is considered a variable to be specified, allowing an extra-sentential element to be a specifier. The past tense is interpreted in terms of a relative order of the values of these variables. Two temporal configurations, the P-configuration ($t_s=t_c>t_e$) and the I-configuration ($t_s>t_c=t_e$), map to the English sentences with past forms depending on how an event is conceived of. In addition to the three temporal terms, the speaker and the cognizer are also posited as primitive variables to be specified. This allows the interpretation of tense in embedded clauses to naturally follow from the principles proposed for simple sentences. The different interpretations of the past tense observed among relative clauses, complements of verbs of thinking and verbs of saying are explained with respect to the intensional world in which the embedded event occurs, and the relative order of the temporal values.

Analysis of the acquisition data of an English-Japanese girl, Mary, in terms of the hypothesis proposed, has revealed that the two temporal configurations mapping to sentences with past forms follow different developmental trends. It has been shown that the mapping of the P-configuration to sentences with past forms is acquired and becomes productive earlier than the mapping of the I-configuration. The results conform to the developmental trend reported in Weist(1986, 1989). Acquisition data support the present hypothesis rather than the Reichenbachian scheme.

Although further study awaits in many areas, only a few of them can be mentioned here. They are: the adult's interpretation of tense in interrogative and negative sentences, and embedded subject clauses; analyses of temporal configurations represented by nonfinite embedded clauses, and the mapping of configurations which involve posterior relation to the Speech time and the Cognition time. Regarding the acquisition of the past verb forms and mapping of the two configurations to sentences with past forms, a comparison of Mary's English and Japanese data will reveal how the development of the conceptual structure and the mapping of the configurations to the linguistic expressions are related.[26] A comparative analysis with data of mono-lingual children is also necessary.

Notes

* The portion of this work which deals with the adult's interpretation of tense, is partially based on my Master's thesis, On the Interpretation of Tense in Finite Embedded Clauses, submitted to Ochanomizu University in 1990. The spontaneous speech collection and the elicited conversation reported here were conducted while I was preparing my M.A. thesis under the supervision of Noriko Imanishi. I would like to thank

her for her valuable suggestions and insightful comments given throughout the preparation of my work, as well as for her constant encouragement and patience.

The present study is a revised version of what I presented at the Keio Psycholinguistics Workshop held on November 13, 1992, at Keio University, Tokyo. I am very grateful to Yukio Otsu, the organizer of the workshop, and Steven Pinker, the discussant, for their valuable comments and suggestions. My thanks also go to the participants of the workshop for their stimulating questions and comments.

I am thankful to John C. Lewis of Ochanomizu University, and John L. Ballard for giving me helpful comments and correcting stylistic errors of the earlier version of this paper. All remaining errors are strictly mine.

Sections 2 through 5 are revised English versions of what appeared in Sano(1990, 1991), and sections 6 and 7 are partly based on Sano(1992). Analysis in section 6.2 is newly added for the present work.

1) The nature of Reference time is not clarified in Reichenbach (1947). It is employed to explain the past perfect, and is always located with the Event time except for the perfects. As Declerck (1986) notes, RT is used to refer to two distinct notions: i) 'The time of the situation being referred to,' and ii) 'the time relative to which the situation is located.' (p. 320) Thus depending on researchers who adopt the Reichenbachian schema, interpretation varies (e.g. Hornstein 1990; Ota 1973; Smith 1978, 1981; Partee 1984), and has often invited criticisms (e.g. Comrie 1985; Nakau 1985; Declerck 1986).

2) In the recent works of linguists who take the model-theoretic approach, the notion of Reference time is revived (e.g. Dowty 1982, Partee 1984). For the reason why Prior(1967) discarded the Reference time see note 5.

3) As will be seen in the discussion in section 5.3.2., the fourth temporal term, the Decoding time(t_d) should also be posited as a primitive. However, for the following reasons and also for the sake of simplicity, the discussion here proceeds as if only the three terms are primitives: Previous works do not incorporate the Decoding time. For simple sentences it is always simultaneous with the Speech time except for some special cases mentioned later in the section.

4) The precise definition of the term 'tense' is not pursued here. In order to clarify the distinction between the semantic representations and corresponding linguistic expressions, I confine my use of 'tense' to the semantic representations and the mapping of them to linguistic expressions.

A simple sentence or a clause with the main verb in the past or present form is referred to here as a sentence/clause with the past or present form.

5) Madvig, cited by Jespersen (1924), was also aware of the time that an event is looked at. For the Latin temporal system, Madvig discriminated between the two futures and the two pasts, i.e., present at the future time versus future at the present, and present at the past time versus past at the present. However, Jespersen (1924) regarded the two to be redundant, and

his view was espoused by Reichenbach (1947).

Among the precursors of tense logic mentioned in Prior (1967), Findley was aware of the time of the intensional world. He posited the equations in (i) as a part of his tense logical laws.

(i) a. x present = (x present) present
b. x future = (x future) present = (x present) future
(Prior (1967) p. 8-9)

Clearly, Findley noted the different points of time from which we look at the extensional world. In the calculus of truth values, however, the two futures in (i) can be treated as equivalent, thus in the tense logic of Prior(1967), such differences are discarded, and the equations in (i) are represented simply as in (ii).

(ii) a. x = x present x present = x
b. x future

6) In Lyons' (1977) original notation, different subscripts are used to represent the different worlds, but for the sake of simplicity, they are represented by the ones employed here.

7) Among many others are, Declerck(1979a, 1979b), Dahl(1981), Langacker(1982) for the former and Vendler (1967), Leech (1971) for the latter.

8) It is considered here that two different temporal relations, $t_c=t_e$ and $t_c>t_e$, map to the auxiliary verb 'have' plus a past participle. The relation $t_c=t_e$ represents only y=a events when mapped onto this form. Therefore a y≠a event must be converted to have the property of a y=a event. We let the $[_T$HAVE + P.P.] represent this temporal relation. The difference between the unmarked y=a event and the event represented by the $[_T$HAVE + P.P.] is that only the onset of an event is bounded in this form. Hence, the event can never be interpreted as terminated, which forces the Cognition time and the Event time to be always simultaneous.

The relation $t_c>t_e$ forces the event to be bounded and terminated. We let the $[_P$HAVE + P.P.] represent this temporal relation. The past form of this is represented here as $[_P$HAVE+ED + P.P.]. As more precise analysis of the structure involving the auxiliary verbs is necessary, we will not go into detailed analysis of these forms here.

9) What is presented in (5) is for English. Other languages such as French need two separate configurations for (5c), i.e. $t_s>t_c=t_e$ (y=a) and $t_s>t_c=t_e$ (y≠a), since they map onto different linguistic expressions.

10) Observe the contrast of (6f) vs. (7d); (6g) vs. (7e); and (6h) vs. (7f). In (6h), which represents the P-configuration, the robber is interpreted as being dead at the Speech time, whereas in (7f), which represents the I-configuration, the interpretation is that s/he is very likely to be alive.

11) Precisely, it is the value of a term that specifies a variable, but we say that a term specifies a variable. Likewise we call a term as a specifier.

12) Weinrich (1977), Partee (1973) and Peterson (1979) suggest

that the temporal reference (of t_c and t_e here) can be either definite or indefinite. When indefinite, it is either specific or nonspecific, just like a nominal reference.

13) The value of the adverbial which specifies the Cognition time does not have to be the one indicating an exact point on the time axis.

(i) Yesterday/ Last week, John swam in the lake.

As in (i) if the value of an adverbial represents a unit on the time axis, and if macroscopically it can be reduced to a point on the time axis, such as, a day of a week, a particular month etc., can serve as a specifier.

14) The specifying Event time and Cognition time do not have to be those of the immediately preceding sentence. See Smith (1978).

15) In other languages such as Turkish, what is directly witnessed by the speaker and what s/he comes to know via other person's reports map to different verb forms.

16) Beside Hornstein (1990), Ota (1973) and Smith (1978, 1981) also adopt Reichenbach's framework to explain the interpretation of tense in embedded clauses. Both Ota (1973) and Hornstein (1990) propose operational principles which work on the schematically represented configurations, and their analyses are confined to a single sentence. Smith (1978, 1981) on the other hand, treats the temporal terms as referential and proposes interpretive rules applicable across sentences.

Ota (1973) does not conform to the SOT rule, but instead proposes movement and deletion rules for the embedded Speech time and the Reference time. The last two problems noted in Hornstein (1990) can be avoided, but the first remains with his theory as well.

Smith's (1978, 1981) theory is free of the problems mentioned above. The analysis presented below has been aided by her discussion of tense in embedded clauses. It should be noted, however, that her analysis of the interpretation of tense in simple sentences is different from the analysis here. She considers that a combination of 'tense' and an adverb establishes the Reference time. In the example, 'Roger called before noon' (Smith 1981, p.216) the combination of past 'tense' and noon specifies a past RT and before indicates that ET precedes RT. The principles below are derived from the analysis of simple sentences seen above, which differs from Smith's (1978, 1981).

17) The research group was organized by Noriko Imanishi (professor) and started the collection of Mary's speech in January 1986. The members of group were Michiko Nishio (professor), Hiromi Kizu Hayashi and Mika Yuzurihara Kobayashi (both undergraduate students then) and I.

18) I would like to thank Mary's parents and grandparents for their understanding and cooperation. I owe special thanks to her mother, who kindly served as an experimenter as well. Only with her help was my study possible. My thanks also go to several former students at Ochanomizu University, especially Hiromi K. Hayashi, Tomomi Kougo and Miwako Shimazu, for their help in transcribing the speech samples. The final check of the

transcription to age 3:4 was done by Noriko Imanishi and thence by me.

19) For claims that early past verb forms mark only an aspectual distinction, see Bronckart and Sinclair (1973), Antinucci and Miller (1976) and Bloom et al. (1980) among others. For claims that early past forms are used deictically to indicate the temporal relation between an event and the Speech time, see Smith (1980), Fletcher (1985) and Weist (1986, 1989).

20) Sounds that cannot be distinguished as speech are indicated by 'xx' and ambiguous speech is in parentheses. Situational contexts are given in brackets.

21) The numbers in parentheses stand for the serial number of the paper, the page where a comparable description is found and, the example number in Imanishi (1987-88).

22) I noted the following points in the analysis of Mary's speech after age 3:4: At age 3:6 one instance of overgeneralization of the -ed inflection (breaked) was observed, and another at 3:11 (teached). Occasional absence of the past marking in required linguistic and situational context was observed until she reached the age of 3:5.

Although the number of English verbs she used was relatively small, Mary's developmental trend for past forms accorded with that of an English mono-lingual child. Sophie's speech samples, reported in Fletcher(1985) show the same general trend noted for Mary at about the same age: At 2:4 Sophie uses verbs only in root forms. At 3:0, the past forms of some irregular verbs and only one instance of a regular verb, are observed. At 3:5 both regular and irregular past forms appear in required context, but an instance of the lack of the past marking is also noted.

23) For 'had' and 'did', there were preceding utterances of her mother using the same verbs in the past forms. No contrastive forms were observed for 'forgot'. This is probably why it is not listed in Imanishi (1987-88). The sentences in which Mary used these verbs were: I found it/ [Mary had a white blanket...What color is it?...It's as white as snow] Mary had white one/ [You did lots of unchi [=feces], didn't you?] I did a big one (excerpted from Imanishi (1987-88)(4; 108; 111) / I forgot (not mentioned in Imanishi) / Ah I spilled (5; 99; 146)/ I opened (6; 93; 162).

24) I excluded the use of 'had' observed in note 23. Because it was a kind of repetition and no other use was observed until sample (16).

25) We just note here that for (27), even if the Cognition time and the Speech time are set at the time when Mary was at school, she could still say "Sharon didn't come," but for (31) it would be "Taisuke isn't here."

26) I would like to thank Steven Pinker for directing my attention to this point.

Appendix A: The Child and the Data Collection Procedure

As the detailed description of Mary's language environment and the data collection procedure are given in Imanishi (1987, 1987-88), only a summary is presented here. Mary is the first child of an American mother and a Japanese father, both with post graduate educations. Since birth, her mother has consistently spoken English with her, (even when with company who speak Japanese). Her Japanese grandparents, who live near by, speak only Japanese with her. Her father spoke English with her until she reached 3:1, but after her return from the United States, mentioned below, he speaks Japanese with her. Her parents converse in English between themselves in her presence. She was born and has been raised in Tokyo. For two months at age 0:11-1:1 and 2:11-3:1 she was with her American grandparents in the United States, during which time, she spoke only English. She attended an international playgroup class at 1:4 and later a nursery school one to three times a week, where the teachers spoke English to the children.

The English and Japanese samples were collected separately, the former at her home and the latter at the home of her Japanese grandparents. Three student members of the research group made home visits two at a time. The language used was according to the place of recording. On each visit, samples were recorded on cassette-tape and video for one and a half hours. The average frequency of the visits was twice a month for English, and the same for Japanese. Besides these recordings by the research group, her mother occasionally provided cassette-tape recordings of conversations with Mary. During her two month stay in the U.S. at 2:11-3:1, only a few tapes were recorded at age 2:11 by her mother. The U.S. stay accelerated her English development, but right after her return to Japan, she did not speak Japanese for a while. During this readjustment period only a few visits were made. Thus there are no samples for the age period of 3:0 to 3:1.

Appendix B: Elicited Conversation at Age 4:4

Purpose:

I conducted a series of experiments to investigate Mary's acquisition of the past forms and the mapping of the configurations to linguistic expressions. Reported here is the first of a series conducted specifically to elicit the use of past forms as naturally as possible, by presenting stimuli via video.

Procedure:

Two short skits from Sesame Street were edited and presented to Mary. After each skit she was asked questions by her mother, who was previously instructed on the object and the procedure of the study. Her mother was instructed not to explain the scenes, and to start with general questions such as 'what happened?' before proceeding to more specific ones. While the child was responding, a plain blue screen was on the video.

Stimuli:

Skit 1: (Duration; two minutes 40 seconds) Ernie stacks seven 'beautiful' cupcakes he has just baked on a plate. While he is gone to get his camera to take a picture of them, Cookie Monster snatches the top cupcake and hides under the table.

Ernie returns and finds that the top cupcake is missing. He is puzzled but he puts another one on the top and tries to take a picture. While he is behind his camera, the top cupcake is lost again. Even more puzzled, Ernie places the last cupcake on the top and then he takes a picture with a flash. Again the top cupcake is gone. After a few seconds, a polaroid picture is developed. There Cookie Monster is, putting a cupcake into his mouth.

Skit 2: (Duration; one minute) A boy wakes up and looks out of the window. He finds it is raining. He gets dressed and puts on his raincoat and rainboots. He runs down the stairs and goes out. But it is sunny out. He goes back to his room and looks out of his window again. He sees rain. He dashes out and finds that what appeared to be rain is water from a sprinkler.

Skit 1 has Ernie's speech, boasting of his cupcakes, counting the cupcakes on the plate, and being puzzled by their disappearance. Skit 2 has only musical accompaniment.

Results:

The mother's questions and the child's answers are shown below.

Skit 1:

CHILD	MOTHER
	Oh Mary, what happened?
	What happened, love?
	That was fun.
	What ...what happened, hmm?
	Hmm, what happened?
	What happened?
(pretends to eat cupcakes)	
	What's that?
	Who did what? Huh?
	What happened, love?
	That was so funny.
	What happened?
	Did you eat all the cupcake?
1 Cookie Monster ate the top cupcake	
	Cookie Monster ate the top cupcake. What did, who, who, whose cupcake were they?
2 Ernie n-toko [Ernie's in Japanese]	
	Ernie's. Umm.
	So Ernie made some cupcakes and then, Cookie Monster ate the top cake.
	Did he do it just once?
3 No (indicating four with the fingers)	
	No? How many times?
4 Four (whisper)	
	Four times. Yeah. I think maybe that was it.
	What was happening? Huh?

Why didn't Ernie know, Mary?

5 'Cause he was taking a picture

He was taking his picture. I see.
Who, how did he know who was taking his cupcakes?
Did he find out who was taking his cupcakes?

6 Because the picture (whisper)

Because what?

7 Picture

Because the picture.
What about the picture?

8 Cookie Monster

Cookie Monster?
Cookie Monster what?

9 Cookie Monster's the name of it?

Cookie Monster is his name.

10 Cookie cookie, cookie

What did he do?
Cookie Monster what?
What kind of picture was it?
What kind of picture..

11 Cookie Monster eating cupcake

Cookie Monster eating cupcakes.
Yes, Cookie Monster was eating his cupcakes.
What about the picture in the very end?

(Mother asked few more questions but Mary didn't answer to any hereafter.)

Skit 2:

Oh that was funny.
That was a funny one, too Mary.
What happened? What happened?

12 The boy went up and got on the hood, he got his shoes and then and then it was raining and the water coming out from the um, uh umm the hose

So the water was coming out from the hose.
In the very beginning, he woke up, didn't he?

13 Um

What did he do after he woke up?
Did he look any place?
Where did he look?
He got up and he looked..
What did he do? He...

14 He looked

He looked where? Under his bed?

15 No

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	He looked where?
16 Guess	
	What?
17 Guess	
	Guess? Guess? ...He looked where? He looked out the window, didn't he?
18 Yes	
	And then what did he think? He looked out the window. What did he think?
19 Raining	
	He thought what?
20 It was raining	
	He thought it was raining, that's right. So then what did he do? What did he put on? Did he put on anything?
21 The raincoat and boots	
	He... He did what?
22 He	
	He ate the raincoat and boots?
23 No!	
	What did he do?
24 He put on the boots and raincoat	
	I see. And then? And then he ran upstaires. Right?
25 No ran down	
	OK. And then wha... wha...what happened when he... Then what did he do, he ran downstaires, and then what did he do?
26 And then... was sunny so he went upstaires again	
	It was sunny so he went upstaires again. And he looked what, then what did he do when he got upstaires?
27 He got upstaires	
	He got upstaires and then what did he do? Did he do anything?
28 It was raining again	
	It was raining again. He thought it was raining again, didn't he? So did he do anything?
29 He put on his raincoat and boots and then, and then went out and then the water was coming out of the hose.	
	And the water was coming out of the hose. That was funny, wasn't it?

It is evident from the results that Mary properly understood the order of events and their causal relations. For Skit 1, her description of the story was not spontaneous but she was being led by her mother's questions, as seen in lines 1 through 11. It is clear from her responses, however, that she properly understood the order of events and their causal relations. For Skit 2, as seen in line 13, she narrated the main events of the scene after being prompted by her mother's first general question. The events she omitted in her first account of what she saw were recounted in correct sequence later as her responses in lines 14 through 29 reveal. No finite embedded clauses were observed in any of her responses.

As marked in lines 1, 5, 12, 14, 20, 24, 26, 27, 28, and 29, she answered with the past forms when asked with the past forms. Furthermore, when an event in the skits was bounded, her response was in the simple past as in 1, 12, 14, 24, 25, 26, 27, 29, and when it was with a constant contour, the answer was then with the past progressive as in 5, 12, 20, 28, 29. Even in an situation like this, Mary distinguished the temporal properties of an event and used an appropriate form in depicting the scene.

The results show that at age 4:4, Mary could map the I-configuration to sentences with past forms. This is evident from her use of past progressives without adverbials in response to questions with the past forms (lines 5, 12, 20, 28, 29). Her narration of the events seen in line 12 suggests that the representation of y≠a events with the I-configuration was also possible at this age.

Note

The use of Sesame Street video skits as stimuli was suggested by Noriko Imanishi.

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